BROOKHAVEN NATIONAL LABORATORY

NATIONAL SYNCHROTRON LIGHT SOURCE

MEMORANDUM

DATE: April 23, 2004

TO: Balwan Hooda, Environmental & Waste Management Services Division

FROM: W. Robert Casey and Nicholas F. Gmür, NSLS

SUBJECT: Review of SDL (DUV-FEL) NESHAPS documents
(gmur\SDL.DIR\NESHAPS-300Eval.doc)

We are updating the Source Development Laboratory (now known as the Deep Ultraviolet-Free Electron Laser) Safety Assessment Document (SAD) to reflect 300 MeV/20 nA/10 Hz operations and equipment. Attached is the1992 NESHAPS evaluation written by Roy Blumberg and reviewed at that time by Gary Schroeder, as well as a 1997 review by Gary of changes since 1992.

The equivalent information available in the draft 2004 SDL SAD revision is as follows:

Air

The greatest potential for air activation is in the 4" air gap that the bremsstrahlung will traverse between the faraday cups and the lead stops behind it. Using the formulation of Swanson (Ref 4, p. 129), activation in air can be calculated assuming a 20 nA beam loss at 300 MeV on the Faraday Cups, and an unshielded bremsstrahlung flight path in air of 4".

Although a variety of other nuclides are produced, the principal radionuclides produced in air are: ^{13}N ($T_{1/2}$ = 10 min., β^+) and ^{15}O ($T_{1/2}$ = 2 min. β^+). The saturation activities of these nuclides are calculated to 8.5 μCi and 0.9 μCi, respectively, for the DUV-FEL operating at a beam power of 6 watts. This activity will be produced along the path of the bremsstrahlung beam before its strikes the lead shielding, and will drift away from the path as a result of air movement. If we assume that the activity is distributed uniformly in a small volume close to the point of production (a cube 3 meters on a side) with no ventilation, the saturation activity concentration is 3.5×10^{-7} μCi/cc for the ^{13}N and ^{15}O mixture. These values can be compared to the Derived Air Concentration for these radionuclides of 4×10^{-6} μCi/cc. Actual values will be far less considering the size of the building and the mixing and ventilation that will occur.

Some production of ^{13}N and ^{15}O will also occur from spallation reactions in air molecules produced by the high energy neutrons (HEN) generated in the faraday cups. These production rates are small compared to that produced by the bremsstrahlung beam.

Please examine the original 1992 NESHAPS document, Gary Schroeder's 1997 review and the current 2004 information given above. Will a cover memo from you be sufficient for review and approval of NESHAPS issues or will the NESHAPS document itself have to be updated?

If you have questions, please contact:

- Bob Casey (x4654) for air activation calculation information;
- Xijie Wang (x5791) for SDL facility information.

We look forward to your reply and guidance.

cc. Xijie Wang, SDL Facility Manager